

Claims

[c1] 1. A slim Universal-Serial-Bus (USB) connector comprising:

- a connector substrate;
- a plurality of metal contacts disposed on a contact surface of the connector substrate, the metal contacts for carrying USB signals;
- locking depressions formed below the connector substrate on a second surface opposite to the contact surface;
- wherein the locking depressions are for receiving metal springs from a female USB connector when the slim USB connector is inserted into the female USB connector; and
- end rails, substantially parallel to the metal contacts, along side edges of the connector substrate, the side edges being smaller in area than the contact surface and the second surface of the connector substrate and disposed between the contact surface and the second surface;
- wherein the end rails are for sliding in gaps between sides of a female connector substrate of the female USB connector and a metal case surrounding the female connector substrate when the slim USB connector is inserted

into the female USB connector.

- [c2] 2. The slim USB connector of claim 1 wherein a width of the slim USB connector is wider than a substrate within a standard male USB connector, but a height of the slim USB connector is less than a height of a metal case surrounding a standard male USB connector, wherein the female USB connector is a standard female USB connector or a slim female USB connector having a reduced height compared with the standard female USB connector.
- [c3] 3. The slim USB connector of claim 2 further comprising: a plurality of dividers, each divider disposed between an adjacent pair of the metal contacts, the plurality of dividers rising above the contact surface of the connector substrate; wherein the plurality of dividers are for filling in a gap between the connector substrate and the female connector substrate when the slim USB connector is inserted into the female USB connector, whereby dividers separate the metal contacts and fill in the gap.
- [c4] 4. The slim USB connector of claim 3 wherein the plurality of dividers are metal dividers formed on the contact surface of the connector substrate, or are plastic dividers.

- [c5] 5.The slim USB connector of claim 2 further comprising:
 - a circuit substrate containing wiring traces;
 - wherein the connector substrate is attached to the circuit substrate or is an extension portion of the circuit substrate.
- [c6] 6.The slim USB connector of claim 5 further comprising:
 - a flash memory chip mounted on the circuit substrate.
- [c7] 7.The slim USB connector of claim 6 further comprising:
 - a controller chip mounted on the circuit substrate, for reading data from and for writing data to the flash memory chip and sending the data over the metal contacts as USB signals to the female USB connector.
- [c8] 8.The slim USB connector of claim 7 further comprising:
 - a plastic case that at least partially surrounds the circuit substrate and covers the flash memory chip and the controller chip.
- [c9] 9.The slim USB connector of claim 8 wherein the locking depressions are formed from a lower portion of the plastic case that at least partially covers the second surface of the connector substrate;
 - wherein the end rails are formed from an upper portion of the plastic case that at least partially covers the contact surface of the connector substrate.

[c10] 10. The slim USB connector of claim 9 further comprising:
a plurality of dividers, each divider disposed between an adjacent pair of the metal contacts, the plurality of dividers rising above the contact surface of the connector substrate;
wherein the plurality of dividers are for filling in a gap between the connector substrate and the female connector substrate when the slim USB connector is inserted into the female USB connector,
wherein the dividers are formed from the upper portion of the plastic case that at least partially covers the contact surface of the connector substrate.

[c11] 11. A Universal-Serial-Bus (USB) connector assembly comprising:
a connector assembly body without a surrounding metal case for insertion into a female USB connector;
end rails on side edges of the connector assembly body, the end rails causing the connector assembly body to have an enlarged width that is greater than a standard width of a standard connector substrate on a standard USB male connector when a metal case surrounding the standard connector substrate is removed;
metal contacts disposed along one or more upper surfaces between the side edges for making electrical contact with the female USB connector; and

engaging depressions, on a bottom surface opposite the one or more upper surfaces, for engaging metal springs on the female USB connector, whereby the engaging depressions and end rails provide a secure fit into the female USB connector when the connector assembly body is inserted without a surrounding metal case.

- [c12] 12. The USB connector assembly of claim 11 further comprising:
 - tabs protruding from a back surface of the connector assembly body, the tabs for making permanent electrical contact to a circuit board;
 - embedded metal extensions of the metal contacts, the embedded metal extensions embedded within the connector assembly body and for connecting the metal contacts to the tabs through the connector assembly body.
- [c13] 13. The USB connector assembly of claim 12 wherein the engaging depressions engage metal springs on a first portion of the female USB connector but do not engage metal springs on a second portion of the female USB connector, whereby some metal springs on the female USB connector are engaged but other metal springs are not engaged.

- [c14] 14.The USB connector assembly of claim 13 wherein a height of the connector assembly body is less than a standard height of the standard USB male connector having the metal case surrounding the standard connector substrate,
whereby the USB connector assembly has a reduced height.
- [c15] 15.The USB connector assembly of claim 14 further comprising:
dividers, each between a pair of the metal contacts, the dividers protruding upward from the one or more upper surfaces.
- [c16] 16.The USB connector assembly of claim 15 wherein the dividers are plastic dividers or are metal dividers.
- [c17] 17.The USB connector assembly of claim 14 wherein the metal contacts are flat metal contacts or are bent metal contacts having a spring action, or are metal rail contacts.
- [c18] 18.The USB connector assembly of claim 14 wherein the tabs are soldered to a circuit board that has a flash memory chip and a controller chip mounted thereon.
- [c19] 19.A reduced-height Universal-Serial-Bus (USB) connector comprising:

connector body means, without a surrounding wrap, for insertion into a female USB connector;

metal contactor means, attached to the connector body means, for making electrical contact with a female USB connector;

engaging means, formed on a lower surface of the connector body means, the lower surface opposite the metal contactor means, for receiving a portion of metal springs on the female USB connector;

end means, on the connector body means, for extending side edges of the connector body means to fill in gaps to sides of the female USB connector produced by lack of the surrounding wrap surrounding the connector body means; and

divider means, attached to the connector body means, for dividing gaps between the metal contactor means, whereby stability when inserted into the female USB connector is increased by the divider means, the end means, and the engaging means.

[c20] 20. The reduced-height USB connector of claim 19 wherein the connector body means comprises a molding or comprises a portion of a circuit board having integrated circuits mounted on other portions thereon and one or more plastic cases partially surrounding the circuit board.

- [c21] 21. The reduced-height USB connector of claim 19 further comprising a reduced-height female connector for mating with the reduced-height USB connector, reduced-height female connector having metal contactor means on only one surface.
- [c22] 22. The reduced-height USB connector of claim 21 wherein power and ground pins provide a higher power supply current than defined by a USB specification.
- [c23] 23. The reduced-height USB connector of claim 21 wherein the metal contactor means comprises four USB contacts and a plurality of additional contacts, wherein the reduced-height USB connector is a reduced-height extended-USB connector or a reduced-height general purpose connector.
- [c24] 24. The reduced-height USB connector of claim 23 wherein the additional contacts comprise extra I/O pins that provide parallel data bits for increased speed or bandwidth transfers.
- [c25] 25. The reduced-height USB contacts connector of claim 23 wherein the additional contacts comprise extra power and ground pins for providing additional supply current or multiple power supply voltages.

- [c26] 26. The reduced-height USB connector of claim 23 wherein the four USB contacts are activated for USB operations and the plurality of additional contacts are activated for extended-USB operations.
- [c27] 27. The reduced-height USB connector of claim 24 wherein the extra I/O pins are for providing increased speed or increased bandwidth multiple-bit data transfers for extended-USB or PCI Express or mini PCI Express operations.